slant length of the entire cone, or the radius of the outer arc, AD; that is,

$$AB : AV :: \angle AVD : 180^\circ;$$

and by inversion, it is

$$AV : AB :: 180^\circ : \angle AVD;$$

hence the angle of the sector is known, and being laid down from some angular instrument, the direction of the line VD is known; therefore, if on the vertex V, as a centre, with the radii VA and V*a*, the arcs AD and *ad* be described, they will constitute the exterior and interior boundaries of the annular segment A*Dda*.

If with the same radii, VA and V*a*, the entire circles ADME and *ad*P*m* be described, they will enclose the entire annulus, of which A*Dda* is a segment, and a circle, of which the area is precisely equal to this annulus, may be determined as follows:—Produce HV, the axis of the cone AVB, to meet the inner boundary of the annulus in P, and through the point P draw the tangent KM, meeting the outer boundary in the points K and M; then is KM the diameter of a circle containing the same area as the entire annulus. On P, as a centre, with the radius PK or PM, describe the circle KLM, and it will be equal to the annulus contained between the concentric circles whose radii are VA and V*a* respectively, and of which the shaded portion, A*Dda*, is equal to the convex surface of the conic frustum or to the circle whose radius is BC.

The problem of converting a circular annulus or ring whose diameters are known, into a circle containing the same area, is also of great practical utility, and might be much more extensively and advantageously employed than it appears to be, was the mode of effecting it generally known; but the reverse problem, or that of converting a given circular area into an annulus of a proposed breadth, is still more extensively useful, and may be applied with great success in many practical operations. It may be as well to illustrate this latter case by an example.

Suppose for instance, that the circle KLM is the transverse section of a solid cylindrical column, which on being applied to a building of a certain magnitude, is found not to possess sufficient strength and stability for the intended purpose, and has therefore to be replaced by another possessing the requisite qualities: but in consequence of some conditions in the contract, the altered column must not contain more metal than that which it is intended to replace; it is therefore obvious that the required strength and stability can only be obtained by making the column hollow and supposing that the thickness of metal is given; let it be required to determine therefrom, the exterior and interior diameters of the column, and describe its section.

Through P the centre of the given circle, draw any diameter as LNP, and another KM at right angles to it; on the radius PL set off PN equal to the given thickness of the metal, and draw KN; bisect KN in Q, and at Q erect the perpendicular QV to meet LP produced in V; then is V the centre of the column. On V as a centre with the radii VP and VN, describe the bounding circles P*dam* and NDAE and the thing is done, the section being represented by the annulus in the figure. The more intelligent readers of THE BUILDER will find no difficulty in applying the above principles to numerical examples, and they will find it to their advantage to render themselves perfectly familiar with the process of construction also.

But in order that nothing may be wanting to render the subject as plain and intelligible as possible, we think proper to adduce the following example, in reference to a case of actual construction.

A cylindrical story post of cast iron, 8 feet long and 4 inches in diameter, was calculated to sustain a pressure of 16 tons, but when placed under a building, and subjected to that strain, it was found to deflect or bend in the middle very nearly an inch; and in order to avoid danger, it has to be replaced by another column of the same weight, but cast hollow, with a thickness of one inch of metal; now the question is, what ought to be the diameters of the hollow column?

The diameter of a cylindrical column sufficient to bear a load of 16 tons with safety, ought in the first place to be 4·18 inches, as calculated by the formula

$$2390 \cdot 5d^4 - d^4w = 0 \cdot 045 l^2 w ;^*$$

where $d$ is the diameter in inches, $l$ the length in feet, and $w$ the load in pounds avoirdupoise. But taking the diameter at 4 inches, as originally cast, the area of section, or the circle KLM, will then be $\frac{1}{4}\pi d^2 = 0 \cdot 7854 \times 4^2 = 12 \cdot 5664$ square inches; and this is the number of inches that must be in the annulus of the hollow column. Now, PN=1 inch and PK=2 inches; therefore, by the property of the circle, we get

$$PV + AV = \frac{PK^2}{PN};$$ that is, $PV + AV = \frac{4}{1} = 4$;

hence it is PV+AV+PN=4+1=5 inches for the diameter of the outer circle, and 5—2 =3 inches for the diameter of the inner one. And with these dimensions, the load which the column will sustain with safety is 19¼ tons; for the strength of a solid column at 3 inches is 7·23 tons, and at 5 inches it is 23·92 tons; but 5 : 3 : : 7·28 : 4·37; hence we have 23·92 —4·37=19·55 tons. T.

* This is the formula investigated by Mr. Tredgold, on the supposition that the direction of the straining-force coincides with the surface of the column.

## WESTMINSTER COURT OF SEWERS.

At a court, held Friday, the 15th instant, Mr. Leslie in the chair, payments were made to the extent of 411*l.* 6s. 4d., the greatest part being for wages to the labourers and artisans employed in cleansing the sewers, cleansing and making new gullies. The Thames Embankment Bill was referred to the officers and solicitors of the court, who were to obtain an interview with the Commissioners of Woods and Forests, to procure the insertion of several clauses, protective of the public interest. Petitions were presented to the court for 7,954 feet of new sewers, and 780 house drains; the greater portion was granted, the remainder to await the special reports of the surveyor.

At two o'clock, pursuant to notice, Mr. Thomas Leverton Donaldson moved, and Mr. Knight seconded, the following:—"That the appointment of Thomas Rowe, as clerk of the works at the meeting of the court held on Friday, the 17th April last, without previous examination by the commissioners, was null and void, being contrary to the practice of the court, and contrary also to the laws of the court (No. 20), no previous notice having been given in the ordinary summons, stating the name of the office, and of the candidate or candidates for such office, &c." Mr. Donaldson's argument in support of his motion was, that the appointment of the new clerk of the works was much at variance with the rules and regulations of the court, and a violation of the privileges of the commissioners. In making the motion he wished to put himself right with the court, as it was only from a sense of duty that he did so, and not to prevent the due dispatch of public business, or from any factious motive whatever. The affair appeared thus on the minutes of the court, 17th of March last:—After public advertisements for candidates, the court assembled to judge of the respective claims, and twelve claimants presented themselves. After four hours' examination, the court resolved, that not one of the candidates was competent to the duties of the office; and Mr. Phillips, the surveyor, was ordered to look out for a proper person, and submit his report to the court. Now he (Mr. D.) complained that the surveyor had not carried out the instructions of the court; he had not reported the name and qualifications of the individual, but the court at once appointed Mr. Rowe for twelve months certain. He had another ground of complaint: a Mr. Knight, who had been examined by the court in April, 1845, and passed the examination satisfactorily, but was unsuccessful on the day of election, had written to the surveyor, and this ought to have been reported to the court.

The surveyor stated, that he had had applications from several parties, but he thought it better to recommend to the court, in the emergency, an individual of whose abilities he had a knowledge than an entire stranger to him.

Mr. Comberlege moved, and Mr. Le Breton seconded, the following amendment to Mr. Donaldson's motion:—"That in order to remove any doubts as to the regularity of the election or appointment of Thomas Rowe, as a clerk of the works, notice be given in the ordinary summons for the next court, in which shall be stated the name of the said Thomas Rowe, as the candidate for the office of fourth clerk of the works, and that the election or appointment shall take place on Friday, the 5th day of June, between the hours of two and three o'clock.

The chairman begged to direct the attention of the court to the circumstances out of which the question had arisen. A clerk of the works being required, the court ordered that advertisements should be inserted in the usual public journals. On the appointed day twelve candidates presented themselves, among whom was one who, in an examination in the year 1836, was reported as competent to the then vacant office of surveyor. But in the examination of 1846, the whole twelve were, after a four hours' inquiry, declared incompetent to the duties the court expected from their clerks of the works. In this emergency, so unexpected, the court ordered the surveyor to try and find a competent person; and as far as he (the chairman) could judge, he had been fortunate, for the public interests, in the selection he had made. It appeared then, that Mr. Rowe, being in a good and permanent situation with the Messrs. Rigby, would not give that up without the prospect of some lengthened engagement with the commissioners, and the court at once, after having failed by public advertisement, secured Mr. Rowe's service for twelve months.

The amendment was then put, and carried by fifteen to one.

During the sitting of the court, orders were passed that notices be inserted in the daily journals, and in THE BUILDER, intimating that the court had approved a plan whereby an efficient drainage at a very moderate cost may be obtained for courts and alleys, and other confined localities, abutting on streets where there are sewers; and that the plans and sections may be seen at the office of the commissioners. It was also ordered, that the report of the surveyor, to which the preceding order refers, together with the plans and sections for the drainage of courts and alleys, be transmitted to the several vestries and paving boards within the jurisdiction of the commission, and that the attention of the vestries and paving boards, be directed to the 57 Geo. 3, cap. 29, clause 56.

## LICHENS ON STONE BUILDINGS.

SIR,—In reply to your correspondent, Mr. Frank Tyrrell, as to some process for removing lichen on sand-stone structures, I beg to suggest to him the employment of a solution of white oxide of arsenic (the common arsenic of commerce) in soft water. This being destructive to vegetable life, will not only kill any lichen already formed, but prevent its recurrence. I have said solution, meaning thereby a real *chemical* transparent solution, not a *mechanical* mixture; and it should be understood, that arsenic, being very difficult of solution, a few pounds would make many gallons of a saturated solution.

As to the application of this solution, I conceive that it should be floated over the faces of the stones before they be laid in their due courses.—I am, Sir, &c., W. BROMET.

WALTHAM ABBEY.—At the last meeting of the British Archæological Society, on the 20th inst., Mr. Croker read a letter from Mr. Chaffers, describing that gentleman's visit to Waltham Abbey, to examine mural paintings said to have been discovered in the church. Just enough had been brought to light to shew, that interesting paintings lay concealed under the white-wash; but the church-wardens have given strict orders that no more white-wash shall be removed. Mr. Chaffers then gave an account of some of the ancient houses for which this place is remarkable.

PRICE OF GAS.—The directors of the Brighton Company have announced, that from the 24th day of June, 1846, up to the 24th of June, 1847, the price, by meter, will be reduced from 9s. to 7s. per 1,000 cubic feet net; and from the 24th day of June, 1847, the price will be further reduced to 6s. per 1,000 cubic feet.